The Energy Orchestrator

Navigating utility transformation in an era of tech disruption, climate uncertainty, and AI innovation

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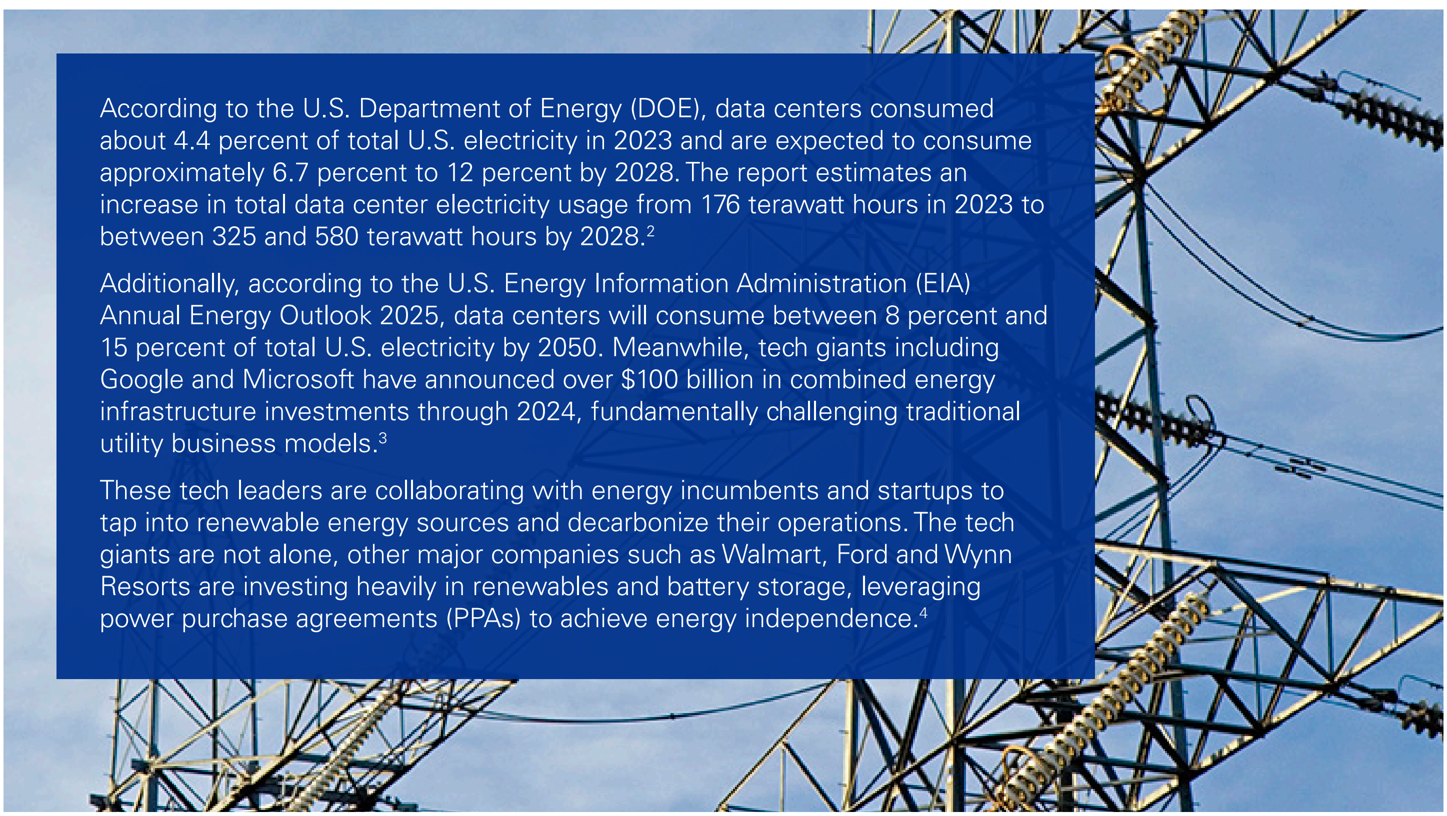
Executive summary

The utility industry stands at a historic inflection point, as traditional models of energy delivery collide with unprecedented technological disruption and increasingly more frequent and destructive climate events. As artificial intelligence reshapes our economy and tech giants evolve from energy consumers to producers, utilities must transform into Energy Orchestrators—dynamic entities that harmonize an increasingly complex ecosystem of power generation, distribution, and consumption.

This transformation to the Energy Orchestrator model couldn't come at a more critical moment. This paper is part of a series examining the role of utility companies in leading the shift to Energy Orchestrators. We explore the evolving role of utility companies, and the impact of technological advances, climate challenges, and artificial intelligence (AI) leadership on the future of energy distribution and management. We also delve into the critical role of large technology platforms in reshaping and enabling the energy landscape through innovative partners and evolving capabilities.

Surging demand, aging grid, and other challenges

The US National Power Demand Study, released in March 2025, which found that electricity demand in the US is projected to surge by 35-50% between 2024 and 2040, driven primarily by AI data centers and new manufacturing activity in the short-term, with electric vehicles, space-heating electrification, and broad economic growth driving the long-term dynamics.[1]



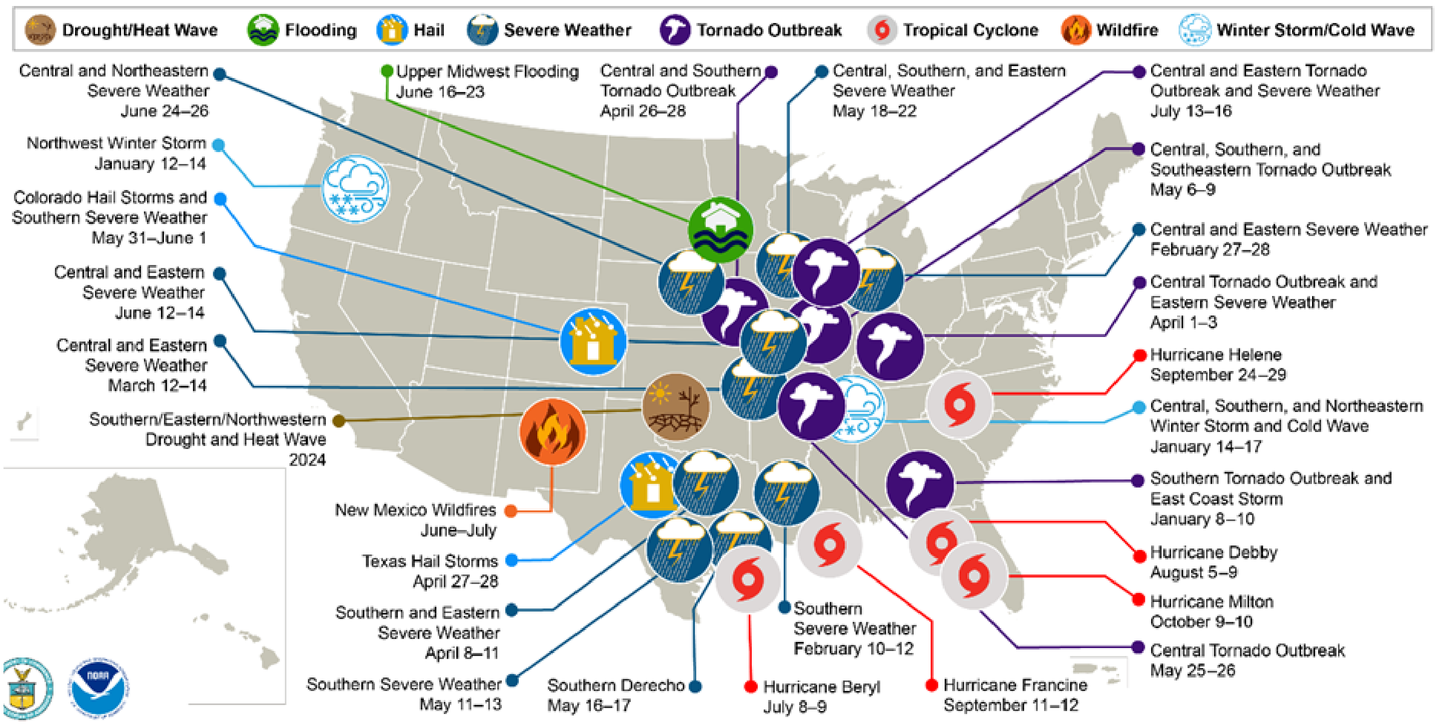
According to the U.S. Department of Energy (DOE), data centers consumed about 4.4 percent of total U.S. electricity in 2023 and are expected to consume approximately 6.7 percent to 12 percent by 2028. The report estimates an increase in total data center electricity usage from 176 terawatt hours in 2023 to between 325 and 580 terawatt hours by 2028.[2]

Additionally, according to the U.S. Energy Information Administration (EIA) Annual Energy Outlook 2025, data centers will consume between 8 percent and 15 percent of total U.S. electricity by 2050. Meanwhile, tech giants including Google and Microsoft have announced over $100 billion in combined energy infrastructure investments through 2024, fundamentally challenging traditional utility business models.[3]

These tech leaders are collaborating with energy incumbents and startups to tap into renewable energy sources and decarbonize their operations. The tech giants are not alone, other major companies such as Walmart, Ford and Wynn Resorts are investing heavily in renewables and battery storage, leveraging power purchase agreements (PPAs) to achieve energy independence.[4]

The stakes couldn't be higher. Climate-driven disasters inflicted $182.7 billion in damages to U.S. infrastructure in 2024 alone, according to NOAA's National Centers for Environmental Information, the fourth-highest annual cost on record.[5] In 2024, the U.S. experienced 27 separate weather and climate disasters that each resulted in at least $1 billion in damages, with Hurricane Helene causing $78.7 billion in damage as the costliest event.[6]

U.S. 2024 Billion-Dollar Weather and Climate Disasters



This map denotes the approximate location for each of the ***27 separate billion-dollar weather and climate disasters that impacted the United States in 2024.***

Meanwhile, the American Society of Civil Engineers recently downgraded the nation's energy infrastructure from a C- to a D+, citing aging grid assets and increasing vulnerability to extreme weather events.[7] Success in this environment requires not just adaptation, but a fundamental reimagining of how utilities operate, invest, and create value.

The evolution of power distribution utilities in the United States:

from the 1980's to 2025 and beyond

The transformation of power distribution utilities in the United States over the past few decades highlights key regulatory, technological, and market-driven changes that have fundamentally reshaped the industry. Understanding this evolution is crucial for energy sector stakeholders as it underscores the dynamic nature of utility operations, policy implications, and the emergent focus on sustainable energy solutions

In the 1980s, the U.S. power distribution landscape was dominated by utility monopolies. These vertically integrated entities controlled the entire electricity value chain, from generation and transmission to distribution. Revenue was generated through regulated infrastructure investments, with minimal competition in defined territories.

The 1990s and 2000s introduced significant regulatory changes aimed at fostering competition and efficiency. Deregulation led to the separation of retail and generation functions, the creation of wholesale electricity markets, and the establishment of independent system operators (ISOs). While generation became competitive, transmission and distribution remained regulated to ensure reliability.

During the 2010s, utilities evolved into "network integrators" to manage increasingly complex grids. This period saw a focus on integrating renewable, distributed energy resources (DERs), modernizing the grid, and deploying smart technologies. Utilities aimed to optimize assets and improve reliability through primarily transactional relationships with technology firms.

Fast forward to 2025 and utilities are transforming into "Energy Orchestrators." This new role involves adopting platform-based business models, partnering strategically with technology giants, and leveraging AI for advanced grid management. Emphasis is placed on climate resilience, diversified revenue streams, and orchestrating data across interconnected energy ecosystems.

1980s

Utility monopolies

- Vertically integrated monopolies
- Owned all generation
- Controlled transmission
- Managed distribution
- Rate-based revenue model

1990s–2000s

Deregulation

- Break up of vertical integration
- Separation of retail and generation
- Creation of wholesale markets
- Independent system operators
- Competitive generation
- Regulated transmission/ distribution

2010s

Network integration

- Distributed generation integration
- Renewable energy growth
- Grid modernization
- Asset optimization focus
- Smart grid technologies
- Transactional relationship with tech companies

2025

Energy orchestration

- Platform business model
- Tech giants as energy producers
- Private microgrids and generation
- Strategic partnerships with technology companies
- AI-driven grid management
- Ecosystem value creation
- Diversified revenue streams

Key drivers of change

- Regulatory changes
- Technological advancements
- Climate change
- Data center energy demand
- AI and digitalization

The tech giant challenge

The emergence of technology companies as energy producers represents perhaps the most significant disruption to the utility model since Thomas Edison first illuminated Pearl Street. Google's $10 billion investment in direct energy infrastructure, including its ambitious partnership with nuclear developer Kairos Power, aims to add 500 megawatts of carbon-free nuclear energy to the grid by 2035.[8] As part of this initiative, Google announced it will purchase power from a fleet of small modular reactors (SMRs) made by Kairos Power.[9]

In late 2024, Microsoft entered into a groundbreaking $30 billion Global AI Infrastructure Investment Partnership for data centers and energy infrastructure. Likewise, Microsoft's procurement of power from the Three Mile Island nuclear plant signals a new era of energy independence for major customers.[10]

Bolstering grid resiliency region by region

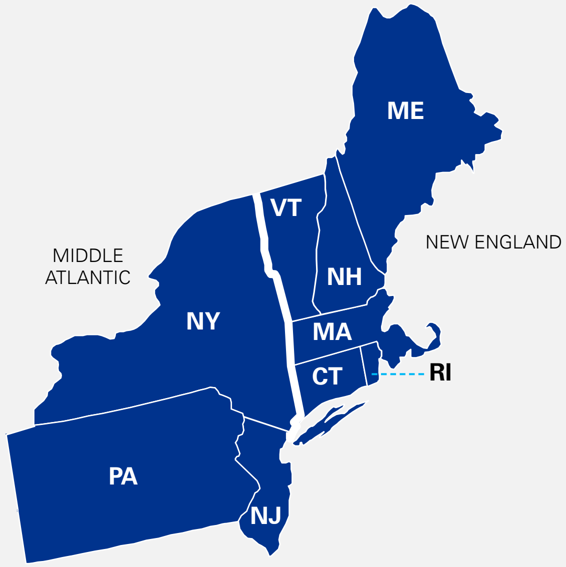
The path to transformation varies dramatically across regions, each facing unique challenges that demand tailored solutions.

The Northeast is facing significant infrastructure challenges due to weather events and a focus on investing in grid level renewables.

Northeast

Con Edison's $1.5 billion "Reliable Clean City" projects demonstrate innovative approaches to **modernizing century-old infrastructure** in dense urban environments.[12]

The utility's comprehensive storm hardening program, born from the harsh lessons of Hurricane Sandy, highlights how **climate resilience shapes modern utility planning**.[13]

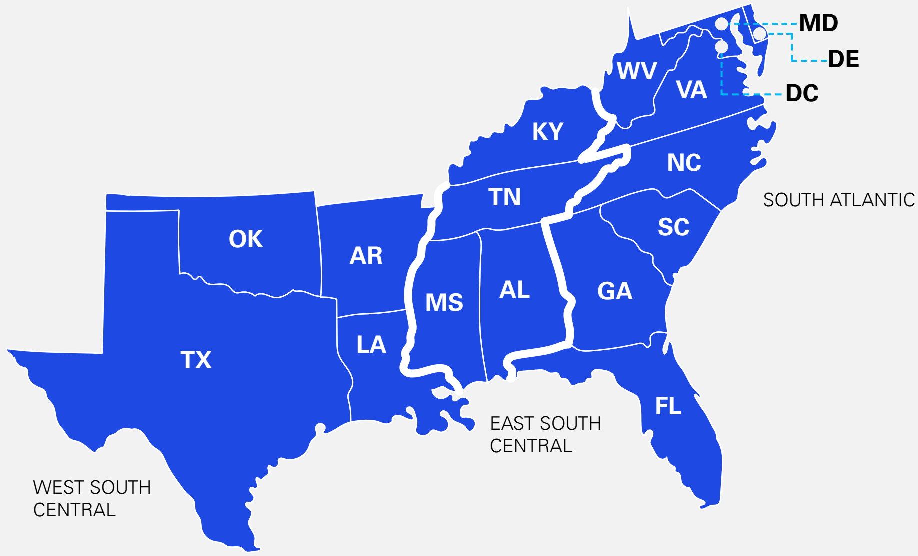


The Southeast tells a different story as utilities navigate the dual challenges of explosive data center growth and increasing storm intensity.

Southeast

Duke Energy's $13 billion grid improvement program exemplifies the region's **forward-thinking approach**, combining traditional reliability enhancements with innovative digital solutions.[14]

Georgia's robust energy grid earned a B grade in the ASCE's 2024 state infrastructure report, compared to the national D+ grade, thanks to billions in **grid upgrades and accelerated transitions** to nuclear, natural gas, and solar energy.[15]



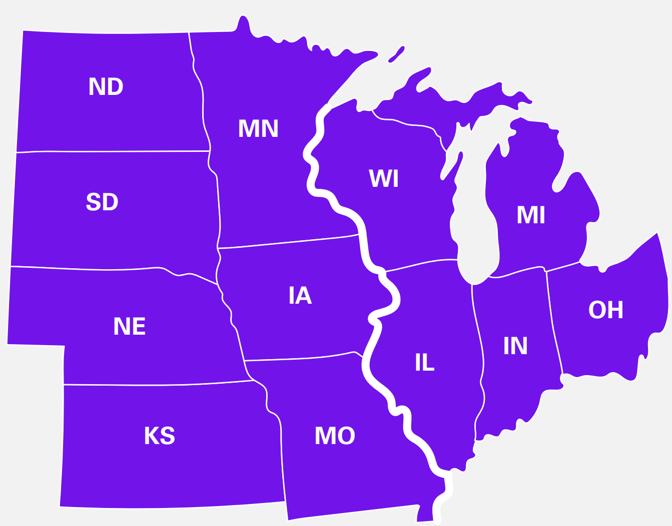
Southern Company's Smart Neighborhood initiatives push the boundaries further, **creating living laboratories** for the future of energy consumption and management.[16]

The Midwest, the U.S. industrial heartland, stands at the crossroads of tradition and transformation.

Midwest

MISO's bold $10.3 billion transmission expansion aims to do more than merely transport power; it seeks to drive a renewable energy revolution and bolster the region's manufacturing resurgence.[17]

AEP's Grid Smart program shows how traditional utilities can **embrace digital transformation** without losing sight of their core mission.[18]

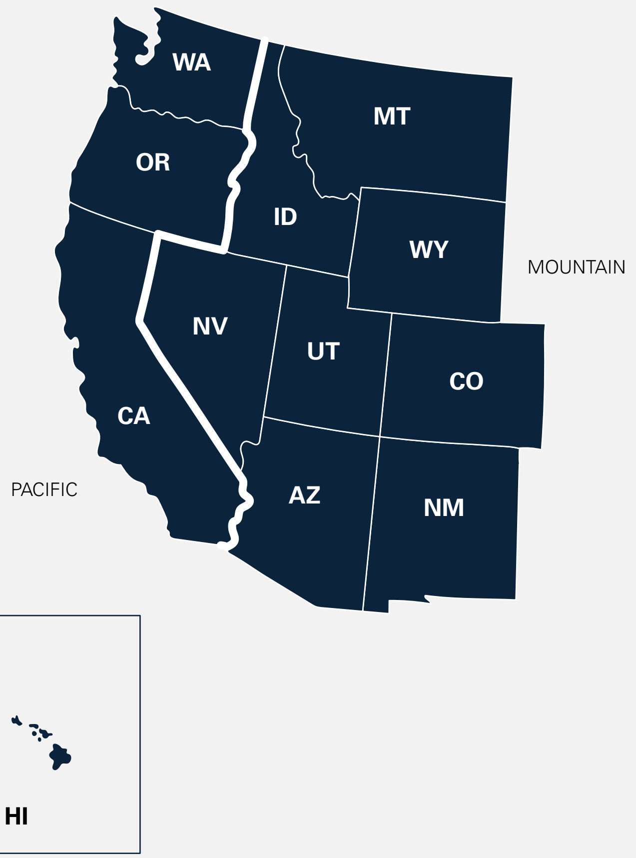


Out West, utilities face an existential dance with climate uncertainty, large renewables investments, and data center consumption.

West

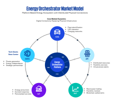
Out West, utilities face an existential dance with climate change. PG&E's $10.9 billion wildfire mitigation program entails comprehensively reimagining of how utilities operate in an era of climate uncertainty.[19]

CAISO's achievement of managing 95 percent renewable penetration during peak periods demonstrates what's possible when innovation meets necessity.[20]



Technology as the transformation enabler

At the heart of this evolution lies the integration of advanced technologies, particularly intelligent enterprise Frameworks and AI. Creating a digital nervous system capable of managing a more complex energy landscape isn't just about updating old systems; it's essential to successfully integrate operational technologies and information technologies. Grid-focused applications such as ADMS, DERMS, EMS, SCADA and WAMS integrated with IoT sensors in the field, weather data and service area imagery all connected to a modern and sophisticated technology platform that will provide the "neural network" needed to orchestrate the consistent delivery of energy.[21]

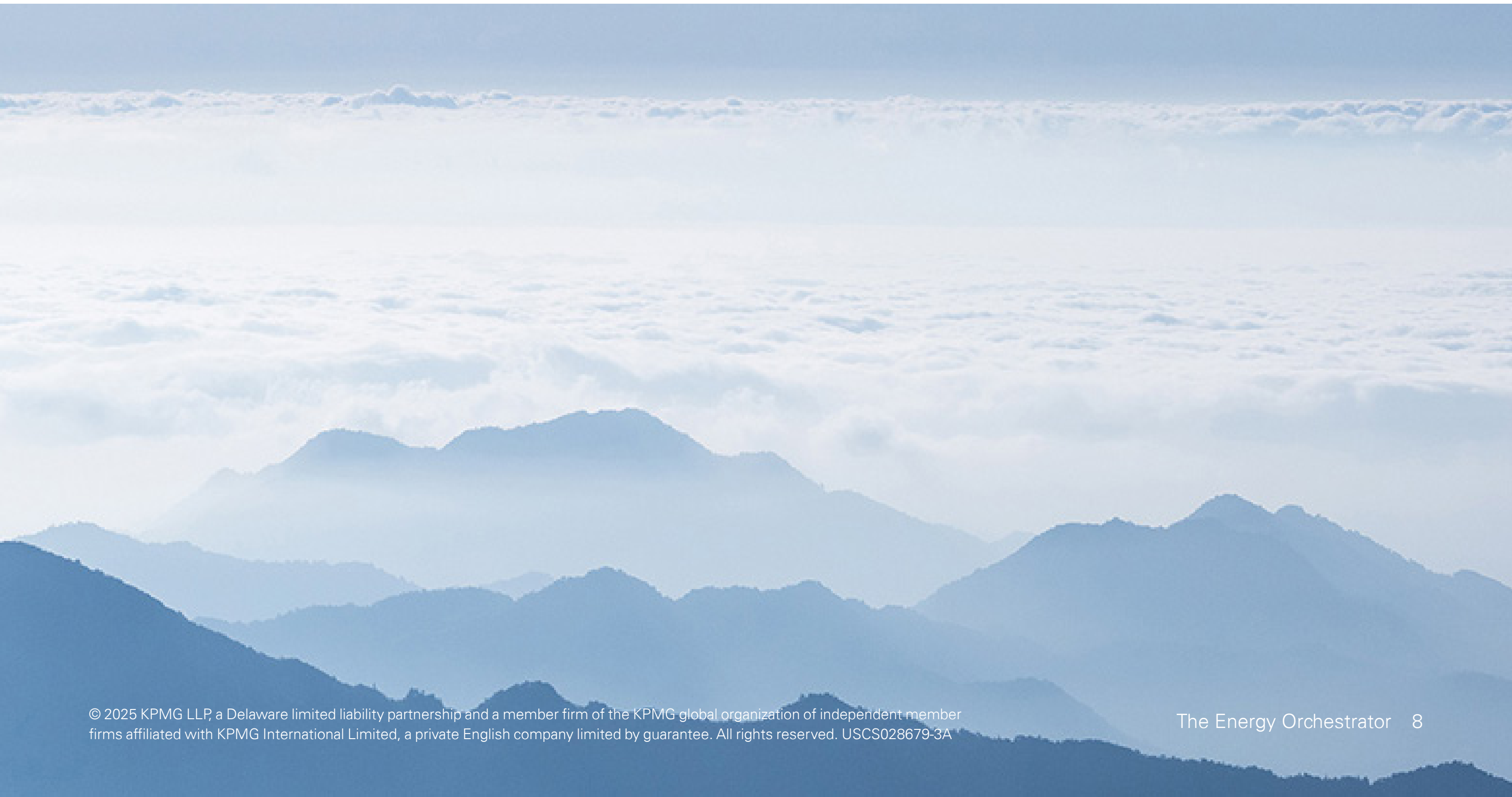


Leading utilities are already seeing remarkable results:

- Florida Power & Light reduced outage response times by 40 percent through intelligent automation.[22]
- San Diego Gas & Electric achieved a 35 percent reduction in maintenance costs through predictive analytics.[23]
- National Grid's digital twin program is revolutionizing how utilities plan and operate their networks.[24]

A fully integrated ERP platform at the center of the technology landscape serves as the digital core of this transformation, providing:

- Real-time operational visibility across vast networks.
- Reductions in maintenance costs using intelligent asset management.
- Advanced analytics enabling precise decision-making.
- Seamless integration of renewable and distributed energy resources.



The AI advantage

AI is fundamentally changing how utilities think about their businesses. Machine learning (ML) algorithms now predict equipment failures before they occur, optimize renewable energy integration, and personalize customer experiences at scale. Recent deployments demonstrate the power of this technology:

25%

Improvement in renewable energy forecasting accuracy.[25]

30%

Reduction in outage duration through predictive analytics.[26]

20%

Decrease in peak demand through AI-optimized demand response.[27]

Implementation framework: The journey to orchestration

The tech giant partnership paradigm

The relationship between utilities and tech giants continues to evolve, requiring careful navigation. Rather than viewing tech giants solely as competitors, forward-thinking utilities are forging innovative partnerships that leverage each entity's strengths. Successful utilities are developing sophisticated partnership models that preserve their essential role while accommodating customers' growing energy independence ambitions.

Consider the collaboration between Microsoft and AEP on data center energy management, which goes beyond traditional utility-customer relationships to create custom reliability solutions for data centers, integrated renewable energy management, shared infrastructure investment models, and innovation partnerships that benefit both parties.[28] This collaboration demonstrates how traditional utilities can maintain their relevance as customers increasingly seek energy independence.

Google and Duke Energy's clean energy partnership demonstrates another model, where 500 megawatts of new solar capacity meets growing data center demand, supported by advanced grid management systems that optimize resource utilization.[29] Several tech companies have announced agreements with utilities to develop large, renewable-energy projects to satisfy growing power needs. These collaborations represent a new approach to utility-customer relationships in the digital age.

The transformation to Energy Orchestrator is more than just a simple technology upgrade; it is a comprehensive process that touches every aspect of utility operations. This journey unfolds across three distinct phases, each building upon the previous while maintaining the delicate balance between reliability and innovation.

Phase one: Building the foundation

The first phase entails establishing the digital foundation necessary for future transformation. At its heart lies the implementation of an ERP platform, creating a real-time operational nervous system that connects every aspect of utility operations. Exelon's successful digital transformation program demonstrates what's possible, having achieved a 40 percent reduction in IT operating costs while simultaneously improving data processing speed by 60 percent.[30]

But technology alone isn't enough. The human element proves equally critical during this phase. Successful utilities are launching comprehensive workforce development programs that combine technical training with cultural transformation. As one utility CIO noted, "We're not just teaching new skills—we're teaching new ways of thinking."

Key foundation elements include:

- Advanced metering infrastructure integration
- Data lake creation for analytics enablement
- Cybersecurity framework enhancement
- Cross-functional team development.

Phase two: Deploying advanced capabilities

As the digital foundation solidifies, utilities can begin deploying more advanced capabilities that truly differentiate the Energy Orchestrator. Duke Energy's Advanced Distribution Management System (ADMS) implementation exemplifies this phase, delivering not just operational improvements but fundamental changes in how the utility manages its network.[31]

The integration of AI and automation during this phase enables:

- Predictive maintenance systems that slash downtime.
- Advanced grid optimization that maximizes asset utilization.
- Customer engagement platforms that transform relationships.
- Distributed energy resource management that enables the grid of the future.

Phase three: Platform orchestration

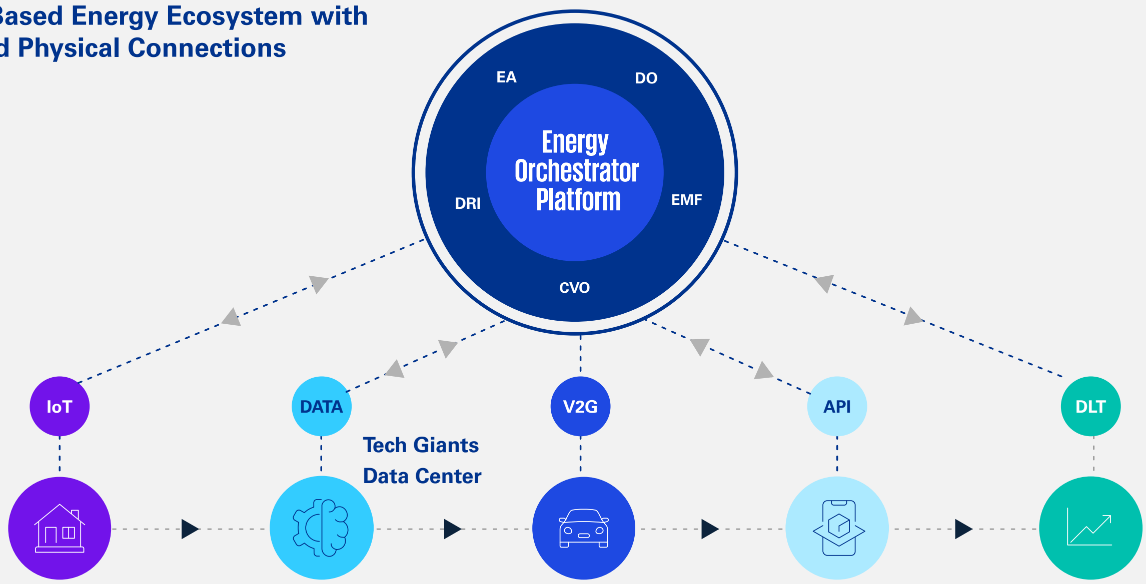
The final phase transforms the utility into a true platform orchestrator, capable of managing an ecosystem of energy resources, market participants, and services. This future state is characterized by new business models and value streams that enable utilities to pull energy from a variety of sources, ensuring their relevance in an increasingly distributed energy world and allowing them to meet the ever-increasing demand for energy. In addition to their portfolio of traditional methods of generation, such as fossil fuels and hydropower, they may need to explore recommissioning nuclear plants, installing SMRs, repurpose coal plants, and integrating DERs to boost their energy supply. Another consideration is to implement strategic grid modernizations—for example, dynamic line rating, flexible AC transmission systems, high-voltage direct current technology, automated voltage regulation, and conversion voltage reduction—to enhance energy capacity with the existing infrastructure.[32]

Emerging capabilities include:

- Blockchain-enabled energy trading platforms
- Peer-to-peer energy networks
- Virtual power plant orchestration
- Flexibility market creation and management.

Energy Orchestrator Market Model

Platform-Based Energy Ecosystem with Distributed Physical Connections



- Energy prosumers
- Demand response
- Personalized services

- Private generation
- Energy independence
- Strategic partnerships

- Fleet electrification
- V2G interation
- Charging networks

- Distributed resources
- Flexibility services
- Virtual power plants

- Peer-to-peer trading
- Flexibility markets
- Blockchain settlements

Acronym key

Core functions:
CVO – Customer Value Orchestrator
DO – Data Orchestration Officer
DRI – Distributed Resource Integrator
EA – Ecosystem Architect
EMF – Energy Market Facilitator

Connections:
API – Application Programming Interface
DLT – Distributed Ledger Technology
IoT – Internet of Things

Other:
DC – Data Center
DER – Distributed Energy Resource
EV – Electric Vehicle
P2P – Peer-to-Peer
V2G – Vehicle-to-Grid
VPP – Virtual Power Plant

Critical enablers

Among the critical enablers of this transformation are advancements in battery technology and supportive regulations.

Advancements in battery technology

Utility-scale battery storage continues to rapidly evolve to support grid stability, renewable energy integration, and energy independence. Around the world governments and utilities are investing heavily in multi-gigawatt battery farms. Advancements in battery technology, including improvements in lithium-ion batteries and ongoing research into alternative battery chemistries such as sodium-ion, solid-state and flow batteries will continue to improve battery performance and drive down costs.[33]

Supportive regulations

Several regulatory changes worldwide are accelerating energy independence by promoting renewable energy, energy storage, and domestic energy production. Governments around the world are creating mandates and subsidies to prioritize and facilitate this agenda. In the United States, FERC Order 2222 allows DERs to participate in the wholesale energy markets which will facilitate the inclusion of numerous sources of energy into this energy orchestration model.[34] In addition, there are DOE loans for battery production and tax credits for clean hydrogen production. All these actions provide a more conducive environment in which this transformation can occur.

Recommendations: Charting the course forward

The path to becoming an Energy Orchestrator requires immediate action coupled with long-term strategic thinking. Successful utilities are focusing on three critical areas:

Digital foundation

Modern utilities must build robust digital capabilities that enable future innovation. This means investing in:

- Core systems modernization
- Data analytics capabilities
- AI/ML platforms
- Cybersecurity enhancement

Organizational evolution

The workforce must evolve alongside technology. Key initiatives include:

- Deploying digital skills development programs
- Embedding a culture of innovation
- Implementing change management frameworks
- Developing partnership capabilities

Business model innovation

New revenue streams and business models ensure long-term sustainability:

- Platform services development
- Energy marketplace creation
- Partnership framework establishment
- Innovation program development

Orchestrating the future

The transformation to Energy Orchestrator represents both an imperative and an opportunity. Those who successfully navigate this evolution will not just survive; they'll thrive, delivering unprecedented value to stakeholders while enabling the clean energy transition.

Based on industry benchmarks, successful transformation can deliver remarkable results:

30–40%

increases in customer satisfaction[35]

25–35%

Acceleration in clean energy integration.[36]

The future belongs to utilities that successfully evolve into Energy Orchestrators, harmonizing traditional infrastructure with new technologies and business models. The technology exists, regulatory frameworks are evolving, and customer demand is clear. The International Energy Agency projects that global electricity demand from data centers alone will reach 1,000 terawatt hours by 2026, equivalent to Japan's entire electricity consumption, necessitating unprecedented grid transformation.[37] Data centers around the world are driving massive increases in electricity demand, with the International Energy Agency projecting that data centers will consume 1,000 terawatt hours annually by 2026, comparable to Japan's total electricity use.[38] The symphony awaits its conductor. The time for action is now.

How KPMG Can Help

As utilities navigate the complex transformation from Network Integrators to Energy Orchestrators, KPMG offers comprehensive support across the entire journey. Our deep industry expertise, combined with specialized capabilities in strategy, business transformation, AI, and data, positions us as the ideal partner to guide utilities through this critical evolution.

Strategic Transformation Support

KPMG's strategic advisors help utilities develop a clear vision and roadmap for their Energy Orchestrator transformation. We work with executive leadership to:

- Assess current capabilities against the Energy Orchestrator model requirements
- Define a strategic vision that balances innovation with reliability obligations
- Develop phased implementation plans that manage risk while accelerating transformation
- Create business cases and value realization frameworks for new platform business models
- Design ecosystem partnership strategies, particularly for tech company collaboration

Business Transformation Expertise

Becoming an Energy Orchestrator requires fundamental changes to operating models, organizational structures, and core processes. KPMG's transformation specialists help utilities:

- Design and implement new organizational structures aligned with Energy Orchestrator roles
- Develop change management strategies that build organizational capability and cultural readiness
- Transform regulatory engagement approaches to support new business models
- Redesign core processes to enable ecosystem orchestration rather than linear operations
- Implement performance metrics that measure platform success and ecosystem value creation

Data & Technology Enablement

The Energy Orchestrator model depends on robust data foundations and advanced technology architecture. KPMG's technology professionals deliver:

- Data strategy development that establishes data as a strategic utility asset
- Technology architecture design for platform integration, advanced analytics, and digital twins
- Implementation support for marketplace technologies and transactional platforms
- Cybersecurity frameworks to protect critical infrastructure while enabling ecosystem collaboration
- Cloud strategy development to support the scalability requirements of the Energy Orchestrator

Transformation Journey Support

KPMG recognizes that each utility's transformation journey is unique. We tailor our support to meet utilities wherever they are on their path to becoming Energy Orchestrators:

Phase 1: Foundation Building

- Capability assessment and gap analysis
- Strategic roadmap development
- Initial use case implementation
- Technology architecture design
- Data governance framework establishment

Phase 2: Capability Scaling

- Platform business model implementation
- Ecosystem partnership development
- Advanced analytics capability expansion
- Regulatory framework evolution
- Organizational redesign and change management

Phase 3: Ecosystem Orchestration

- Full-scale platform deployment
- Sophisticated ecosystem value optimization
- Advanced AI implementation
- Performance-based regulatory models
- Continuous innovation frameworks

By partnering with KPMG, utilities gain access to a powerful combination of industry knowledge, transformation experience, and technical expertise designed specifically to support the journey to becoming successful Energy Orchestrators in a rapidly evolving energy landscape

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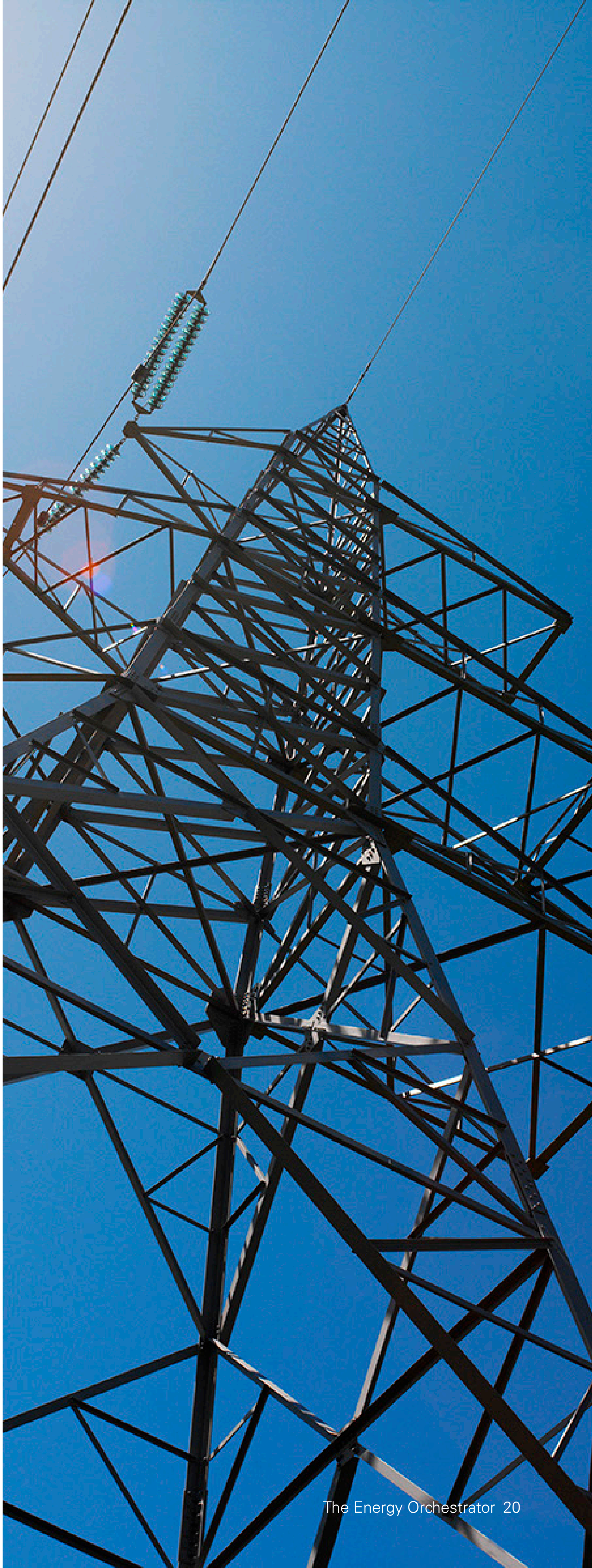

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